Technical Capabilities

- **Four newly constructed testbeds**
  - **Two cells per testbed, 600sf each**
  - **One rotating testbed**
  - **One double-height 'big box' testbed**
  - **7000SF total new testbed construction**
- **Virtual design and visualization testbed**
- **Control hardware testbed**
- **Occupied plug-load and lighting testbed**

Interchangeable Envelope Elements
- South facing and portion of north façade including glazing and opaque assemblies
- Exterior/Interior shading devices
- Reconfigurable roof insulation levels

Commercial Interiors
- Variable ceiling heights to 11'6" above finished floor
- Potential for raised access floor to 2-ft height
- Partitioning for core/perimeter zoning, up to 3 zones per cell
- Two cells may be combined for larger floor-plan layouts

HVAC
- One air handler per cell
- Dedicated central plant for every testbed, chilled and hot water
- Reconfigurable zonal systems (VAV, fan coil, radiant panels, chilled beam, displacement, under floor)
- Thermally isolated radiant topping slab with rigid insulation
- Up to three radiant in-slab zones per cell

Rotating Testbed
- Configurable ceiling, HVAC, lighting, facades, access floor
- Resets position every 60 seconds to align with solar orientation for dynamic tests
- Enables testing at other orientations, e.g. west facing

High Bay Testbed
- Reconfigurable skylights and clerestories
- 25-foot floor to ceiling height
- 25ft x 25ft floor-plate for equidistant daylight measurement
- Accommodates interstitial floor for 2-story applications
- Double height replaceable southern facade

Data Acquisition (DAQ) & Controls System
- Local DAQ server per cell
- Ethernet and power raceways for cell sensors & instrumentation
- Telecomm services local to each cell
- Secure database per cell
- LabView based controls with customizable scripting tool
  - Base HVAC controls
  - Control sequences for other systems (lights, shades, etc.)
- Full monitoring and data visualization capabilities
- Interface capabilities for simulation and controls platforms

Instrumentation (Partial)
- Power metering
  - HVAC, lighting, MELS at circuit and device level
  - Whole building, and end use level metering
- Thermal load measurement
  - Chilled and hot water Mag flow meters with temp sensor at each cell
- Other instrumentation
  - Occupancy sensors
  - Air supply flow measurements
  - Room pressure
  - Lighting & glare measurements
  - Envelope components, thermal measurements
  - Calibration capabilities

Initial Fit Out Of Testbeds
- Each testbed's replaceable components will initially match performance characteristics of different eras
  - 1980S ashrae (two cells)
  - 90.1-2010 (three cells)
  - Title 24 2013 (three cells)
  - Net-zero design (one cell)

Occupied Lighting & Plug Load Testbed
- Interior tenant improvement to Building 90
- Two zones for comparative studies
- All lighting individually circuited, metered and programmable
- Easily replaceable fixtures (plug-in)
- Occupancy sensors: computer, cube and lighting zone
- Outlets individually circuited and controllable
- Task / ambient lighting systems

Virtual Design Testbed
- Two rooms
- Four SmartBoards per room
- Teleconferencing and large-scale visualization capabilities
- BIM through BEM platform interoperability testing

Controls Hardware Lab
- Lab bench environment with soldering station
- Robust networking infrastructure access
- Controls mockup, testing and measurement equipment